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09/060,825	04/16/1998	ROBERT BRENNAN	680148	1023

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H SAMUEL FROST
BERESKIN & PARR
BOX 401
40 KING STREET WEST
TORONTO, M5113Y
CANADA

EXAMINER	
TRAN, CON P	

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2644	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/060,825	Applicant(s) BRENNAN, ROBERT	
	Examiner Con P. Tran	Art Unit 2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 April 1998* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 12-24* is/are rejected.

7)☒ Claim(s) *7-11* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

1. Applicant should provide updated information regarding related application as mentioned on page 6 line 5 of the specification in response to this office action.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2 and 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Eguchi et al. (Eguchi; U.S. Patent No. 5,337,366).

Regarding claim 1, Eguchi et al. teach a method for reducing noise in a signal (see col. 6 lines 25-27). The method comprising the steps (see Fig.1 and respective portion of the specification):

(1) supplying the input signal u(n) to an amplification unit (17);

(2) subjecting the input signal to an auxiliary noise reduction algorithm (31), to generate an auxiliary signal (y_2);

(3) using the auxiliary signal (y_2) to determine a control input for the amplification unit (16); and

(4) controlling the amplification unit (16) with the control signal (y_2), to generate an output signal (y) with reduced noise (see col. 9, lines 8-11).

Regarding claim 2, Eguchi et al. teach a method for reducing noise in a signal (see col. 6 lines 25-27, Fig.1 and respective portion of the specification), wherein the input signal (u) is subjected to a main noise reduction algorithm (32), to generate a modified input signal (u_2), which is supplied to the amplification unit (16).

Regarding claim 3, Eguchi et al. teach a method for reducing noise in a signal (see col. 6 lines 25-27, Fig.1 and respective descriptions), wherein the main reduction algorithms (32) and the auxiliary noise reduction algorithms (31) are different.

4. Claims 4-6 and 14 are rejected under 35 U.S.C. 102(e) as being anticipated by Händel. (Händel; PCT WO 96/24128).

Regarding claim 4, Händel teaches a method of reducing noise (see page 2, lines 10-12) in an input, audio signal containing speech (see page 2, lines 3-6), the method comprising the steps of (see Fig. 1 and Fig. 7):

(1) detecting the presence and absence of speech utterances (see page 4, lines 1-5; and page 5, lines 22-28);

(2) in the absence of speech (see page 5, lines 13-15), determining a noise magnitude spectral estimate (140);

(3) in the presence of speech comparing the magnitude of the audio signal (130) to the noise magnitude spectral estimate (see page 5, lines 15-21);

(4) calculating (see page 16 lines 1-page 17, lines 24) an attenuation function (16) from the magnitude spectrum of the audio signal (130) and the noise magnitude spectral estimate (140); and

(5) modifying (see page 17, lines 24-30) the input signal by the attenuation function (16) to generate an output signal $\{\hat{S}(k)\}$ with reduced noise (see page 18, lines 1-2).

Regarding claim 5, Händel teaches a method of reducing noise (see page 2, lines 12-13) in an input, audio signal containing speech (see page 2, lines 3-6), wherein (see page 3, lines12-14) the square of the speech magnitude spectral estimate ($\Phi_x(w)$) is determined by subtracting the square of the of the noise magnitude spectral estimate ($\Phi_v(w)$) from the square of the magnitude spectrum of the input signal ($\Phi_s(w)$).

Regarding claim 6, Händel teaches a method of reducing noise (see page 2, lines 10-12) in an input, audio signal containing speech (see page 2, lines 3-6), wherein (see page 7, Table 2, line 8) the attenuation function (i.e. $\hat{H}_{\delta PS}(w)$ is calculated in accordance with the following equation:

$$H(f) = \{ (| X(f) |^2 - \beta | N\hat{}(f) |^2) / | X(f) |^2) \}^{\alpha}$$

Where: $H(f) = \hat{H}_{\delta PS}(w)$, attenuation function (see page 7, line 2-3)

$X(f) = \hat{\Phi}_x(w)$, magnitude spectrum of the input audio signal (see page 3, line 26-27)

$N\hat{}(f) = \hat{\Phi}_v(w)$, noise magnitude spectral estimate (see page 4, line 3-4)

$\beta = \delta$, oversubtraction factor (see page 26, lines 6-7)

α = ½ , an attenuation rule

Regarding claim 14, Händel teaches a method of reducing noise (see page 2, lines 10-12) in an input, audio signal containing speech. The method includes detecting speech with a modified auto-correlation (i.e., autoregressive, page11, lines 14-15).

5. Claims 21, 22 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Borth et al. (Borth; U.S. Patent No. 4,628,529).

Regarding claim 21, Borth et al. disclose an apparatus for reducing noise in a signal (see Fig. 1). The apparatus including an input (110) for a signal and an output (150) for a noise reduced signal. The apparatus comprising an auxiliary noise reduction means (125) connected to the input (110) for generating an auxiliary signal output to an amplification means (130). The amplification means (130) connected to the input (110) for receiving the original input signal. The amplification means (130) also being controlled by the auxiliary signal to generate an output signal with reduced noise (see col. 4, lines 29-30) to the output (135).

Regarding claim 22, Borth et al. disclose an apparatus for reducing noise in a signal (see Fig. 1). The apparatus including an input (110) for a signal and an output (150) for a noise reduced signal. The apparatus comprises an amplification and an auxiliary noise reduction. The auxiliary noise reduction comprising:

(1) detection means (125) connected to the input (110) and providing a detection signal indicative of the presence of a desired audio signal (see col. 4, lines 21-25);

(2) magnitude means (120) for determining the magnitude spectrum of the input signal (110), with both the detection means (125) and the magnitude means (120) being connected to the input (see col. 4, lines 17-20);

(3) spectral estimate means (125) for generating a noise magnitude spectral estimate and being connected to the detection means (itself) and to the input (110) of the apparatus (see col. 4 lines 21-25); and

(4) noise filter calculation means (130) connected to the spectral estimate means (125) and the magnitude means (120), for receiving the noise magnitude spectral estimate and magnitude spectrum of the input signal to produce the auxiliary signal and having an output for the auxiliary signal connected to the amplification means (itself).

Regarding claim 23, Borth et al. disclose an apparatus for reducing noise in a signal (see Fig. 1); wherein the auxiliary noise reduction means including a frequency transform means (115) connected between input (110) and both of the magnitude means (120) and the spectral estimate means (125) for transforming the signal into the frequency domain to provide a transformed signal wherein the magnitude means (120) determines the magnitude spectrum from the transformed signal, and wherein the spectral estimate means (125) determines the noise spectral estimate from the transformed signal (see col. 4 lines 15-30).

6. Claims 17-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Yasunaga. (Yasunaga; U.S. Patent No. 4,845,753).

Regarding claim 17, Yasunaga teaches a method of determining the presence of speech (Abstract, line 6-12) in an audio signal (see Fig. 4). The method comprising

taking a block of in input audio signal (see col. 3 lines 39-40) and performing an auto-correlation (S42) on that block to form a correlated signal (see col. 3 lines 43-45); and checking (S53) the correlated signal for the presence of a periodic signal having a pitch corresponding to that for speech (see col. 2 lines 58-61, col. 3 lines 65-67).

Regarding claim 18, Yasunaga teaches a method of determining the presence of speech (Abstract, line 6-12) in an audio signal (see Fig. 4), wherein the auto-correlation (S42) is performed on a first block taken from an audio signal (see col. 3 lines 43-45), and a delayed block (S44) from the audio signal (see col. 3 lines 45-58).

Regarding claim 19, Yasunaga teaches a method of determining the presence of speech (Abstract, line 6-12) in an audio signal by performing auto-correlation (see Fig. 4), wherein each block is subdivided into a plurality of shorter sections (S43) and the correlation comprises correlation between pairs of the shorter sections (S46) to form partial correlations (S48), and subsequently summing the partial correlations to obtain the correlated signal (S52, and see col. 3 lines 40-67).

Regarding claim 20, Yasunaga teaches a method of determining the presence of speech (Abstract, line 6-12) in an audio signal by performing partial correlation (see Fig. 4), wherein an input signal is stored as a plurality of samples (S43) in a pair of correlation buffers (S47), and the auto-correlation is performed on the signals in the buffers to determine the partial correlations (S48), which partial correlations are summed and stored (S52, and see col. 3 lines 40-67).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Händel (Händel; PCT WO 96/24128)

Regarding claim 12 , the Händel reference discloses a method of noise reduction. However, the reference does not explicitly include remotely turning noise suppression on and off.

Nevertheless, as would have been well known in the art at the time the invention was made, such remote control is conventional for turning an electronics device on and off. Accordingly, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to include remotely turning noise suppression on and off because such method is conventional.

Regarding claim 13, the Händel reference discloses a method of noise reduction. However, the reference does not explicitly include automatically disabling noise reduction in the presence of very light noise or extremely adverse environments.

Nevertheless, as would have been well known in the art at the time the invention was made, such specifications are required in order to preserve battery power and to protect user from extremely loud environments. Accordingly, it would have been obvious

to one of ordinary skill in the art, at the time the invention was made to include automatically disabling noise reduction in the presence of very light noise or extremely adverse environments because such specifications would preserve battery power and to protect user from extremely loud environments.

9. Claims 15, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Händel (Händel; PCT WO 96/24128) in view of Nakajima et al. (Nakajima; U. S. Patent No. 4,283,601).

Regarding claim 15, Händel teaches a method of reducing noise (see page 2, lines 10-12) in an input, audio signal containing speech (see page 2, lines 3-6). The method includes detecting speech with a modified auto-correlation. However, Händel does not disclose detecting speech with (partial) auto-correlation function. In an analogous art, Nakajima et al. teach a method of detecting speech (see Fig. 3 and Fig. 6) by using (partial) auto-correlation because the synthesis of degrees of agreement of partial auto-correlation coefficients enhance the filter stability (see col. 1, lines 57-59 and col. 10, lines 28-31). Nakajima et al. further teach:

(1) taking an input sample and separating it into short blocks (160) and storing the blocks in correlation buffers (see col. 6, 42-43);

(2) correlating the blocks (160) with one another, to form partial correlations (111, see col. 6, lines 51-58); and

(3) summing the partial correlations(141,151) to obtain a final correlation see col. 6, lines 58-63).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combines within Händel's method the (partial) auto-correlation function method to detect the speech as taught by Nakajima in order to enhance the filter stability (see col. 1, lines 57-59 and col. 10, lines 28-31).

Regarding claim 16, both of Händel (see page 4 line 22- page 5 line 2) and Nakajima (see col. 5 lines 9-13) teach methods of detecting speech directly in the frequency domain by using digital signal processing with Fast Fourier Transform. Nakajima et al. further teach a method of detecting speech (see Fig. 3 and Fig. 6) by using Fast Fourier Transform (7, and see col. 5 lines 9-18) to generate partial correlations (see col. 6 lines 28-36) because the synthesis of degrees of agreement of partial auto-correlation coefficients enhance the filter stability (see col. 1, lines 57-59 and col. 10, lines 28-31).

10. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Borth et al. (Borth; U.S. Patent No. 4,628,529) in view of Händel (Händel; PCT WO 96/24128).

Regarding claim 24, Borth et al. disclose an apparatus for reducing noise in a signal as recited in claim 23 (see Fig. 1), wherein the noise filter calculation means (130) determines the square of the speech magnitude spectral estimate by subtracting the square of the noise magnitude spectral estimate from the square of the magnitude spectrum of the input signal (see col. 4 lines 26-30). However, Borth et. al. does not disclose the noise filter calculation means (130) calculates the auxiliary signal as an attenuation function with an oversubtraction factor and an attenuation rule. In an

analogous art, Händel discloses a method of reducing noise (see page 2, lines 10-12) in an input, audio signal containing speech (see page 2, lines 3-6), wherein (see page 7, Table 2, line 8) the attenuation function means (24, Fig. 1) calculates the auxiliary signal as an attenuation function because the method attenuation function with an oversubtraction factor and an attenuation rule gives a better noise reduction without sacrificing audible quality (see page 2, lines 12-13). Händel further discloses the equation:

$$H(f) = \{ (| X(f) |^2 - \beta | N\hat{}(f) |^2)/ | X(f) |^2) \}^{\alpha}$$

Where: $H(f) = \hat{H}_{\delta PS}(w)$, attenuation function (see page 7, line 2-3)

$X(f) = \Phi\hat{}_x(w)$, magnitude spectrum of the input audio signal (see page 3, line 26-27)

$N\hat{}(f) = \Phi\hat{}_v(w)$, noise magnitude spectral estimate (see page 4, line 3-4)

$\beta = \delta$, oversubtraction factor (see page 26, lines 6-7)

$\alpha = ½$, an attenuation rule

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine Borth's system with the noise filter calculation means (24, Fig. 1) as taught by Händel to calculate the auxiliary signal as an attenuation function with an oversubtraction factor and an attenuation rule in order to achieve a better noise reduction without sacrificing audible quality (see page 2, lines 12-13 and page 18, lines 1-2).

Allowable Subject Matter

11. Claims 7-11 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding to claim 7, the prior art provided numerous examples of different noise reduction methods but failed to disclose or fairly suggest the specific functional limitation as specify in claim 7, specifically the oversubtraction factor β is varied as a function of the signal to noise ratio, with β being zero for high and low signal to noise ratios and with β being increased as the signal to noise ratio increases above zero to a maximum value at a predetermined signal to noise ratio and for higher signal to noise ratios β decreases to zero at a second predetermined signal to noise ratio greater than the first predetermined signal to noise ratio.

Regarding to claim 8, the prior art provided numerous examples of different noise reduction methods but failed to disclose or fairly suggest the specific functional limitation as specify in claim 8, specifically the oversubtraction factor β is divided by a reemphasis function P(f) to give a modified oversubtraction factor $\hat{\beta}$ *(f)*, the preemphasis function being such as to reduce β at high frequencies, and thereby reduce attenuation at high frequencies.

Regarding to claim 9, the prior art provided numerous examples of different noise reduction methods but failed to disclose or fairly suggest the specific functional limitation

as specify in claim 9, specifically the rate of change of the attenuation function is controlled to prevent abrupt and rapid changes in the attenuation function.

Regarding to claim 10, the prior art provided numerous examples of different noise reduction methods but failed to disclose or fairly suggest the specific functional limitation as specify in claim 10, specifically the attenuation function is calculated at successive time frames, and the attenuation function is calculated in accordance with the following equation :

$$G_n(f) = (1-\gamma)H(f) + \gamma G_{n-1}(f)$$

Wherein $G_n(f)$ and $G_{n-1}(f)$ are the smoothed attenuation functions at the n'th and (n-1) 'th time frames, and y is a forgetting factor.

Regarding to claim 11, the prior art provided numerous examples of different noise reduction methods but failed to disclose or fairly suggest the specific functional limitation as specify in claim 11, specifically β is the function of perceptual distortion.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Nishiguchi et al. U.S. Patent 5,809,455 disclose a method and a device for discriminating a voice sound from an unvoiced sound or background noise in speech.

b. Eatwell U.S Patent 5,742,694 discloses a noise reduction filter for enhancing noisy audio signals such as speech or music.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Con P. Tran whose telephone number is (703) 305-2341. The examiner can normally be reached on M - F (8:30 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forester W. Isen can be reached on (703) 305-4386. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9314 for regular communications and (703) 872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

cpt CPT
November 7, 2001

FORESTER W. ISEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2700